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FLOOD INSURANCE STUDY

GEAUGA COUNTY, OHIO

UNINCORPORATED AREAS

NOVEMBER 4, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 390190

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

GEAUGA COUNTY, UNINCORPORATED AREAS, OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Geauga County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Buffalo District, (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1822, Project Order No. 1. This study was completed in September 1986.

1.3 Coordination

On May 17, 1985, an initial Time and Cost meeting was held with representatives from FEMA, the Ohio Department of Natural Resources (ODNR), Geauga County, and the Study Contractor. The selection of streams to be studied was determined.

On December 10, 1987, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Geauga County, Ohio. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

Flooding caused by overflow of Bridge Creek, West Branch Bridge Creek, Unnamed Tributary to Aurora Branch Chagrin River, the East Branch Chagrin River, the West Branch Cuyahoga River, Swine Creek, the Chagrin River, Silver Creek, and West Branch Silver Creek was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Map for Geauga County, Ohio (Reference 1) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through September 1991. The scope and methods of study were proposed to and agreed upon by FEMA and Geauga County.

2.2 Community Description

Geauga County is located in northeastern Ohio and has a total land area of 408 square miles. It is bordered by Cuyahoga County, the City of Solon, and the Villages of Bentleyville, Chagrin Falls, Gates Mills, and Hunting Valley on the west; Lake County, the City of Kirtland, and the Village of Kirtland Hills on the north; Ashtabula and Trumbull Counties on the east; and Portage County on the south. Geauga County is served by U.S. Routes 6, 87, 322, and 422. Geauga County is primarily rural. The 1980 population was reported to be 74,474 (Reference 2).

The climate of Geauga County is humid continental, typified by warm, humid summers and cold winters. Lake Erie is probably the most important influence on the weather of Geauga County, directly affecting both the temperature and precipitation patterns of the area.

The average annual temperature is about 49.5 degrees Fahrenheit (^{o}F). Temperatures range from an average yearly low of about 35.5 ^{o}F to an average high of approximately 58.6 ^{o}F. During the growing season, the mean temperature is around 65.5 ^{o}F.

The mean annual level of precipitation is about 44.9 inches, with the driest months of the year being July, August, and September. The first measurable snow falls around the middle of November. During the winter, air masses moving over Lake Erie become saturated and often develop into snow squalls upon reaching the higher elevations in the county. Geauga County receives approximately 100 to 110 inches of snow annually (Reference 3).

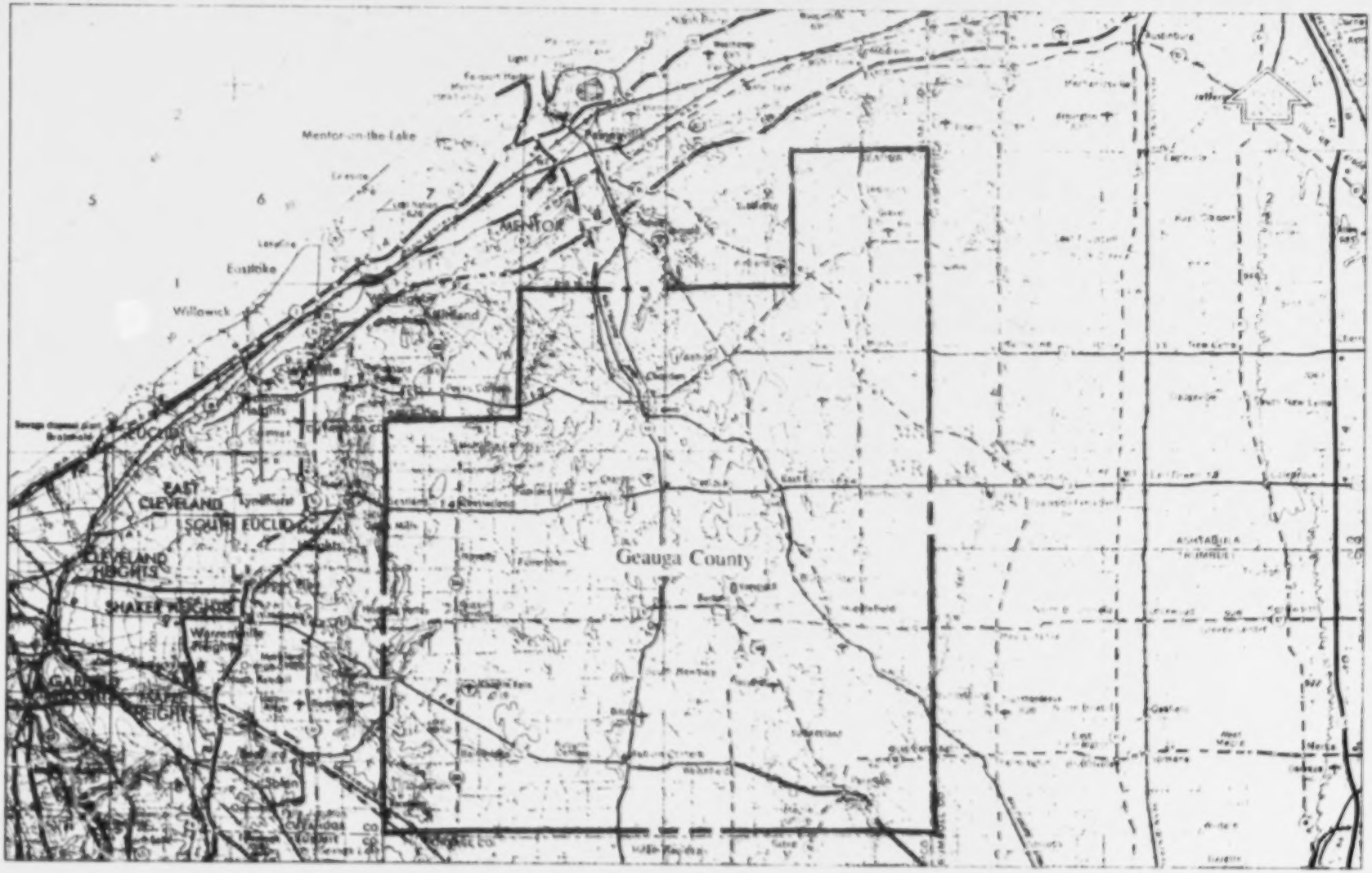


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

5 0 5 10 15 MILES

VICINITY MAP

2.3 Principal Flood Problems

Because most of the county is rural, floods are not well documented. Flooding occurred throughout much of Ohio in March of 1913. However, no specific information was obtained relative to Geauga County for this flood.

A flood occurred in Geauga County in January 1959. It was reported that more than 15 inches of water rushed through the main business district of the Village of Middlefield at the height of the storm. High flood waters forced the closing of State Route 168 south of the Village of Burton (Reference 4).

Localized flooding occurred from heavy thunderstorms on June 11, 1986, causing basement flooding, damage to roads, and erosion. Most of the flooding occurred on stream reaches not studied in detail for this study.

2.4 Flood Protection Measures

There are no existing flood protection measures within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The discharges for all streams were established using ODNR Bulletin No. 45 (Reference 5). Basin characteristics, such as drainage area, channel slope, and surface storage were determined from U.S. Geological Survey (USGS) topographic maps (Reference 6). Using the regression equations in Table 1 of Bulletin 45 and basin characteristics, the discharges were established.

Peak discharge-drainage area relationships for the 100-year flood of each flooding source studied in detail in the community are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the streams studied were obtained by field survey and topographic maps. Bridges were surveyed to obtain elevation data and structural geometry. Cross sections between bridges were interpolated using the streambed slope and topographic maps at a scale of 1:2400 with a contour interval of 2 feet (Reference 7).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map.

Water-surface profiles were developed using the HEC-2 step-backwater computer program (Reference 8). On the main streams, computations were started at critical depth. For tributary streams, water-surface elevations at normal depths were used for starting elevations.

Channel roughness factors (Manning's "n") and contraction and expansion loss coefficients used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and the floodplain areas. Manning's "n" values used for calculating the water-surface profiles are listed below:

Stream	Channel	Overbank
Bridge Creek	0.02-0.09	0.04-0.10
West Branch Bridge Creek	0.045	0.08
Chagrin River	0.02-0.06	0.04-0.09
East Branch Chagrin River	0.045	0.08
West Branch Cuyahoga River	0.035-0.05	0.05-0.10
Silver Creek	0.03-0.04	0.05
West Branch Silver Creek	0.03-0.04	0.05-0.08
Swine Creek	0.02-0.07	0.04-0.09
Unnamed Tributary to Aurora Branch Chagrin River	0.045	0.08

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
UNNAMED TRIBUTARY TO AURORA BRANCH CHAGRIN RIVER		
just upstream of Crackel Road	11.0	1,560
about 750 feet downstream of Riverview Drive	2.0	480
EAST BRANCH CHAGRIN RIVER		
0.2 mile upstream of Mitchell's Mill Road	26.5	4,580
0.8 mile upstream of Kirtland Road	22.4	4,160
SWINE CREEK		
at eastern county boundary	11.1	2,090
about 2,950 feet upstream of Bundysburg Road	10.5	1,990
about 2.9 miles upstream of Bundysburg Road	6.7	1,280
CHAGRIN RIVER		
2,780 feet downstream of Kinsman Road	55.4	4,520
just upstream of confluence of Silver Creek	39.7	3,430
at Mayfield Road	10.5	1,220
at downstream end of Bass Lake	7.7	1,060
WEST BRANCH CUYAHOGA RIVER		
just downstream of Unnamed Tributary located 5,000 feet downstream of Mayfield Road	19.9	2,540
just downstream of Mayfield Road	13.6	1,800
at downstream end of Lake Aquilla	11.3	1,730

TABLE 1 - SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
BRIDGE CREEK		
at intersection with Washington Street	13.8	1,660
just downstream of confluence of West Branch Bridge Creek	6.5	980
at Stafford Road	4.7	760
WEST BRANCH BRIDGE CREEK		
at Stafford Road	1.8	510
SILVER CREEK		
at mouth	13.9	2,120
just downstream of confluence of West Branch Silver Creek	10.9	1,880
just upstream of confluence of West Branch Silver Creek	6.4	1,210
WEST BRANCH SILVER CREEK		
at mouth	4.5	1,080
1,900 feet upstream of Music Street	3.3	840

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:24000 and 1:2400 with contour intervals of 10 and 2 feet, respectively (References 6 and 7).

The 100-year floodplain boundary is shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for Geauga County (Reference 1).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and the 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway for Swine Creek lie outside the county boundary.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than a 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CHAGRIN RIVER								
A	500	85	611	7.5	1000.8	1000.8	1001.3	0.5
B	2400	42	444	10.3	1005.6	1005.6	1006.4	0.8
C	4500	336	2030	2.3	1009.1	1009.1	1009.7	0.6
D	7630	201	1013	3.4	1012.0	1012.0	1013.0	1.0
E	10,500	60	410	8.1	1013.8	1013.8	1014.8	1.0
F	12,000	470	2318	1.5	1016.5	1016.5	1017.1	0.6
G	14,000	200	994	3.5	1019.9	1019.9	1020.4	0.5
H	16,860	269	1155	3.0	1024.5	1024.5	1025.5	1.0
I	19,000	150	868	4.0	1028.5	1028.5	1029.1	0.6
J	20,000	240	1089	3.2	1029.9	1029.9	1030.4	0.5
K	20,625	66	479	7.2	1030.4	1030.4	1031.3	0.9
L	21,500	227	947	3.6	1032.4	1032.4	1033.0	0.6
M	0[2]	169	663	1.9	1105.0	1105.0	1105.6	0.6
N	999[2]	41	189	6.5	1108.8	1108.8	1108.8	0.0
O	1287[2]	38	219	5.6	1110.6	1110.6	1110.7	0.1
P	3000[2]	140	570	2.2	1115.1	1115.1	1115.6	0.5
Q	4030[2]	251	1097	1.1	1119.7	1119.7	1119.7	0.0
R	4640[2]	477	399	3.1	1122.7	1122.7	1122.9	0.2
S	6720[2]	77	293	4.2	1128.9	1128.9	1129.9	1.0
T	9700[2]	157	606	2.0	1139.2	1129.3	1140.0	0.8
U	10,000[2]	84	317	3.9	1140.1	1140.1	1140.6	0.5

[1]FEET ABOVE LIMIT OF DETAILED STUDY (2400 FEET DOWNSTREAM FROM KINSMAN ROAD)
[2]FEET ABOVE LIMIT OF DETAILED STUDY (1000 FEET DOWNSTREAM FROM MAYFIELD ROAD)

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

CHAGRIN RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
EAST BRANCH CHAGRIN RIVER								
A	120	120	847	5.4	829.9	829.9	830.6	0.7
B	1750	100	522	8.8	834.0	834.0	834.4	0.4
C	2200	96	697	6.6	837.2	837.2	837.2	0.0
D	5000	90	858	5.3	847.7	847.7	847.9	0.2
E	6000	80	615	6.8	849.8	849.8	850.0	0.2
F	6700	111	711	5.8	852.5	852.5	853.1	0.6
G	8250	105	620	6.7	856.9	856.9	857.7	0.8
H	10,120	65	490	8.5	864.5	864.5	864.6	0.1
UNNAMED TRIBUTARY TO AURORA BRANCH CHAGRIN RIVER								
A	255[2]	70	348	4.5	1043.0	1043.0	1043.0	0.0
B	750[2]	612	5300	0.3	1043.4	1043.4	1043.4	0.0
C	2075[2]	89	483	3.2	1044.1	1044.1	1044.2	0.1
D	3750[2]	60	384	4.1	1047.1	1047.1	1047.6	0.5
E	4350[2]	33	245	6.4	1050.2	1050.2	1050.5	0.3
F	5200[2]	30	224	7.0	1051.8	1051.8	1052.5	0.7
G	6800[2]	86	401	1.2	1058.3	1058.3	1059.2	0.9
H	7485[2]	25	158	3.0	1060.3	1060.3	1061.3	1.0
I	7850[2]	123	782	0.6	1060.6	1060.6	1061.5	0.9
J	8120[2]	40	155	3.1	1064.2	1064.2	1064.2	0.0

[1]FEET ABOVE MITCHELL'S MILL ROAD
[2]FEET ABOVE DAM

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

EAST BRANCH CHAGRIN RIVER–
UNNAMED TRIBUTARY TO AURORA BRANCH CHAGRIN RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SWINE CREEK								
A	0	67[3]	271	7.8	908.5	908.5	908.5	0.0
B	1020	52	221	9.5	918.9	918.9	918.9	0.0
C	3500	49	233	9.0	935.9	935.9	936.3	0.4
D	6270	63	306	6.9	955.0	955.0	955.4	0.4
E	8800	54	175	6.9	972.9	972.9	973.4	0.5
F	11,410	28	195	6.2	995.9	995.9	996.8	0.9
G	12,840	37	161	7.5	1014.2	1014.2	1014.5	0.3
H	14,370	23	93	6.5	1033.4	1033.4	1033.8	0.4
WEST BRANCH CUYAHOGA RIVER								
A	850[2]	400	1659	1.5	1132.1	1132.1	1133.0	0.9
B	3982[2]	75	510	3.5	1135.0	1135.0	1135.9	0.9
C	4168[2]	300	1627	1.1	1135.4	1135.4	1136.3	0.9
D	6090[2]	550	2419	0.7	1135.8	1135.8	1136.7	0.9

[1]FEET ABOVE COUNTY BOUNDARY
[2]FEET ABOVE LIMIT OF DETAILED STUDY (4000 FEET DOWNSTREAM FROM MAYFIELD ROAD)
[3]THIS WIDTH EXTENDS BEYOND COUNTY BOUNDARY

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

SWINE CREEK– WEST BRANCH CUYAHOGA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
BRIDGE CREEK								
A	0	105	379	3.3	1148.9	1148.9	1149.4	0.5
B	1699	41	282	4.5	1152.1	1152.1	1153.0	0.9
C	2140	171	932	1.4	1153.3	1153.3	1154.0	0.7
D	5900	65	340	2.9	1157.2	1157.2	1158.2	1.0
E	8800	174	663	1.5	1160.2	1160.2	1161.2	1.0
F	10,980	111	451	1.7	1165.2	1165.2	1166.2	1.0
G	12,499	155	636	1.2	1167.2	1167.2	1168.2	1.0
H	13,600	258	986	0.8	1170.2	1170.2	1170.3	0.1
WEST BRANCH BRIDGE CREEK								
A	1500[2]	70	178	2.9	1166.3	1166.3	1166.7	0.4
B	1850[2]	20	57	8.9	1167.3	1167.3	1167.3	0.0
C	2500[2]	110	377	1.4	1169.8	1169.8	1170.0	0.2
D	3200[2]	38	95	5.3	1170.9	1170.9	1171.4	0.5
E	4600[2]	130	450	1.1	1174.3	1174.3	1175.0	0.7
F	5050[2]	63	199	2.6	1175.0	1175.0	1175.7	0.7

[1]FEET ABOVE LIMIT OF DETAILED STUDY (1700 FEET DOWNSTREAM FROM WASHINGTON STREET)
[2]FEET ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

BRIDGE CREEK–WEST BRANCH BRIDGE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SILVER CREEK								
A	725	189	469	4.5	1012.0	1012.0	1012.0	0.0
B	3700	200	630	3.4	1014.6	1014.6	1015.6	1.0
C	4890	41	223	9.5	1018.5	1018.5	1019.0	0.5
D	5505	85	585	3.6	1021.5	1021.5	1022.1	0.6
E	7540	85	429	4.9	1023.9	1023.9	1024.8	0.9
F	9860	90	370	5.3	1029.1	1029.1	1030.0	0.9
G	10,380	53	275	7.1	1030.4	1030.4	1031.1	0.7
H	11,650	101	480	3.9	1034.4	1034.4	1035.1	0.7
I	12,445	38	209	9.0	1035.0	1035.0	1035.9	0.9
J	14,250	550	3439	0.5	1041.8	1041.8	1041.8	0.0
K	16,680	150	463	2.6	1042.4	1042.4	1042.6	0.2
L	17,970	108	268	4.5	1048.1	1048.1	1048.4	0.3
M	22,200	100	343	3.5	1061.1	1061.1	1062.1	1.0
N	24,100	100	149	5.8	1067.3	1067.3	1067.4	0.1
O	26,640	100	233	3.7	1071.9	1071.9	1072.7	0.8
P	31,000	94	227	3.8	1082.9	1082.9	1083.7	0.8
WEST BRANCH SILVER CREEK								
A	1000	70	286	3.8	1046.6	1046.6	1047.3	0.7
B	4660	70	260	4.1	1062.9	1062.9	1063.5	0.6
C	6610	70	204	5.3	1072.4	1072.4	1073.2	0.8
D	7340	43	181	4.6	1076.8	1076.8	1077.5	0.7
E	8130	80	217	3.9	1079.5	1079 5	1080.5	1.0
F	10,780	55	199	4.2	1090.0	1090.0	1090.7	0.7

[1]FEET ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

SILVER CREEK– WEST BRANCH SILVER CREEK

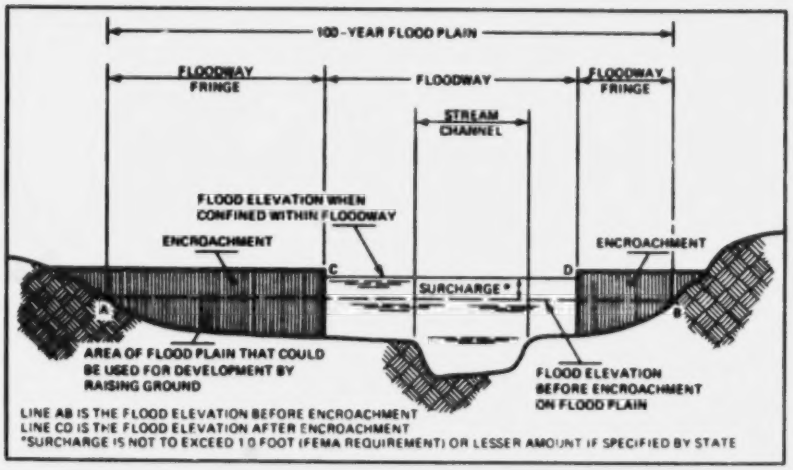

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Flood Insurance Studies have been published for Ashtabula, Cuyahoga, and Lake Counties; the Cities of Kirtland and Solon; and the Villages of Hunting Valley, Bentleyville, Chagrin Falls, and Gates Mills, Ohio (References 9-17) and are in agreement with this study.

Flood Insurance Rate Maps printed for Portage County and the Villages of Moreland Hills, Chardon, and Kirtland Hills, Ohio (References 18-21) are in agreement with this study.

The Flood Insurance Study for Trumbull County, Ohio (Reference 22) is not in agreement with this study due to the more detailed flooding information for Swine Creek included in this study.

A COE report titled "Flood Plain Information, East Branch Chagrin River, Lake and Geauga Counties, Ohio" (Reference 23) is not in agreement with this study due to changes in hydrology and the replacement of the Mitchell's Mill Road bridge since the COE report was published.

A Flood Insurance Study in progress for the Village of Middlefield, Ohio (Reference 24) is in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Geauga County (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604.

9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Geauga County, Unincorporated Areas, Ohio, December 1977.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Ohio, Washington D.C., February 1982.

3. Geauga County Planning Commission, Chardon, Ohio, letter dated June 5, 1986.

4. Geauga Times Leader, Chardon, Ohio, January 29, 1959.

5. Ohio Department of Natural Resources, Division of Water, Bulletin No. 45, Floods in Ohio, Magnitude and Frequency, Columbus, Ohio, May 1977.

6. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series Topographic Map, Scale 1:24000, Contour Interval 10 Feet: Middlefield, Ohio, 1959, photorevised 1970; South Russell, Ohio, 1963, photorevised 1984; Mantua, Ohio, 1959, photorevised 1970; Thornville, Ohio, 1961, photorevised 1985; Burton, Ohio, 1966; Painesville, Ohio, 1960, photorevised 1970; Garrettsville, Ohio, 1959, photorevised 1970; Mentor, Ohio, 1963, photorevised 1970; Chagrin Falls, Ohio, 1963, photorevised 1984; Twinsburg, Ohio, 1963, photorevised 1984; Chardon, Ohio, 1966, photorevised 1979; Chesterland, Ohio, 1963; Mayfield Heights, Ohio, 1963, photorevised 1970.

7. Sanitary Engineering Department, Chardon, Ohio, Topographic Maps, Scale 1:2400, Contour Interval 2 Feet: Geauga County, Ohio, April 1965 and 1974.

8. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, January 1981.

9. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Ashtabula County, Unincorporated Areas, Ohio, January 1981.

10. ————, Flood Insurance Study, Cuyahoga County, Unincorporated Areas, Ohio, April 1986.

11. ————, Federal Insurance Administration, Flood Insurance Study, Lake County, Unincorporated Areas, Ohio, January 1981.

12. ————, Federal Insurance Administration, Flood Insurance Study, City of Kirtland, Lake County, Ohio, February 1980.

13. ————, Federal Insurance Administration, Flood Insurance Study, City of Solon, Cuyahoga County, Ohio, February 1981.

14. ————, Federal Insurance Administration, Flood Insurance Study, Village of Hunting Valley, Cuyahoga and Geauga Counties, Ohio, February 1978.

15. ————, Federal Insurance Administration, Flood Insurance Study, Village of Bentleyville, Cuyahoga County, Ohio, August 1980.

16. ————, Federal Insurance Administration, Flood Insurance Study, Village of Chagrin Falls, Cuyahoga County, Ohio, July 1980.

17. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Village of Gates Mills, Cayahoga County, Ohio, April 1978.

18. Federal Emergency Management Agency, Flood Insurance Rate Map, Portage County, Unincorporated Areas, Ohio, September 1987.

19. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Rate Map, Village of Moreland Hills, Cuyahoga County, Ohio, June 1979.

20. Federal Emergency Management Agency, Flood Insurance Rate Map, Village of Chardon, Geauga County, Ohio, January 1985.

21. ————, Flood Insurance Rate Map, Village of Kirtland Hills, Lake County, Ohio, October 1984.

22. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Trumbull County, Unincorporated Areas, Ohio, September 1978.

23. U.S. Army Corps of Engineers, Buffalo District, Flood Plain Information, East Branch Chagrin River, Lake and Geauga Counties, Ohio, July 1976.

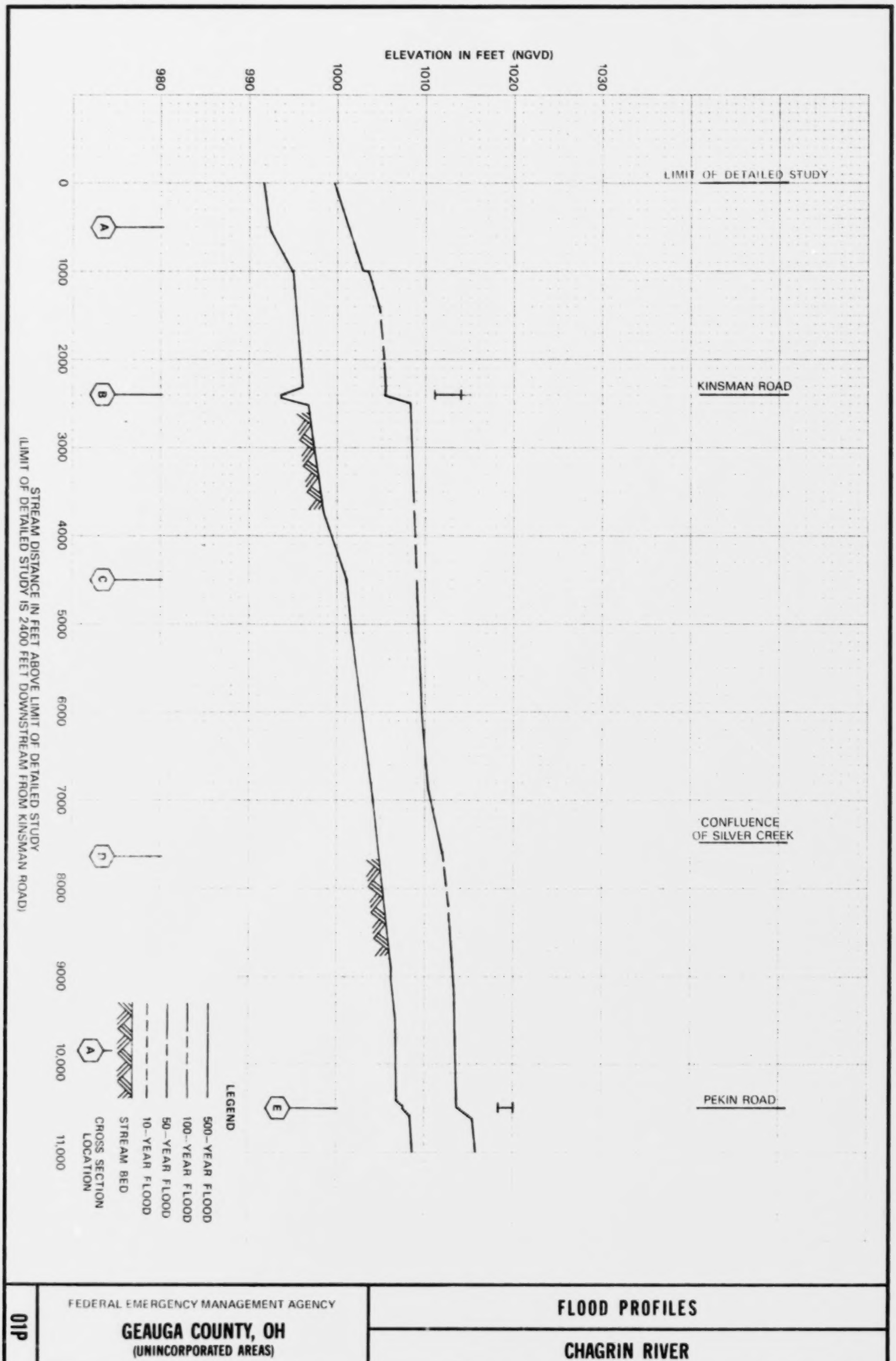
24. Federal Emergency Management Agency, Flood Insurance Study, the Village of Middlefield, Geauga County, Ohio, in progress.

ELEVATION REFERENCE MARKS

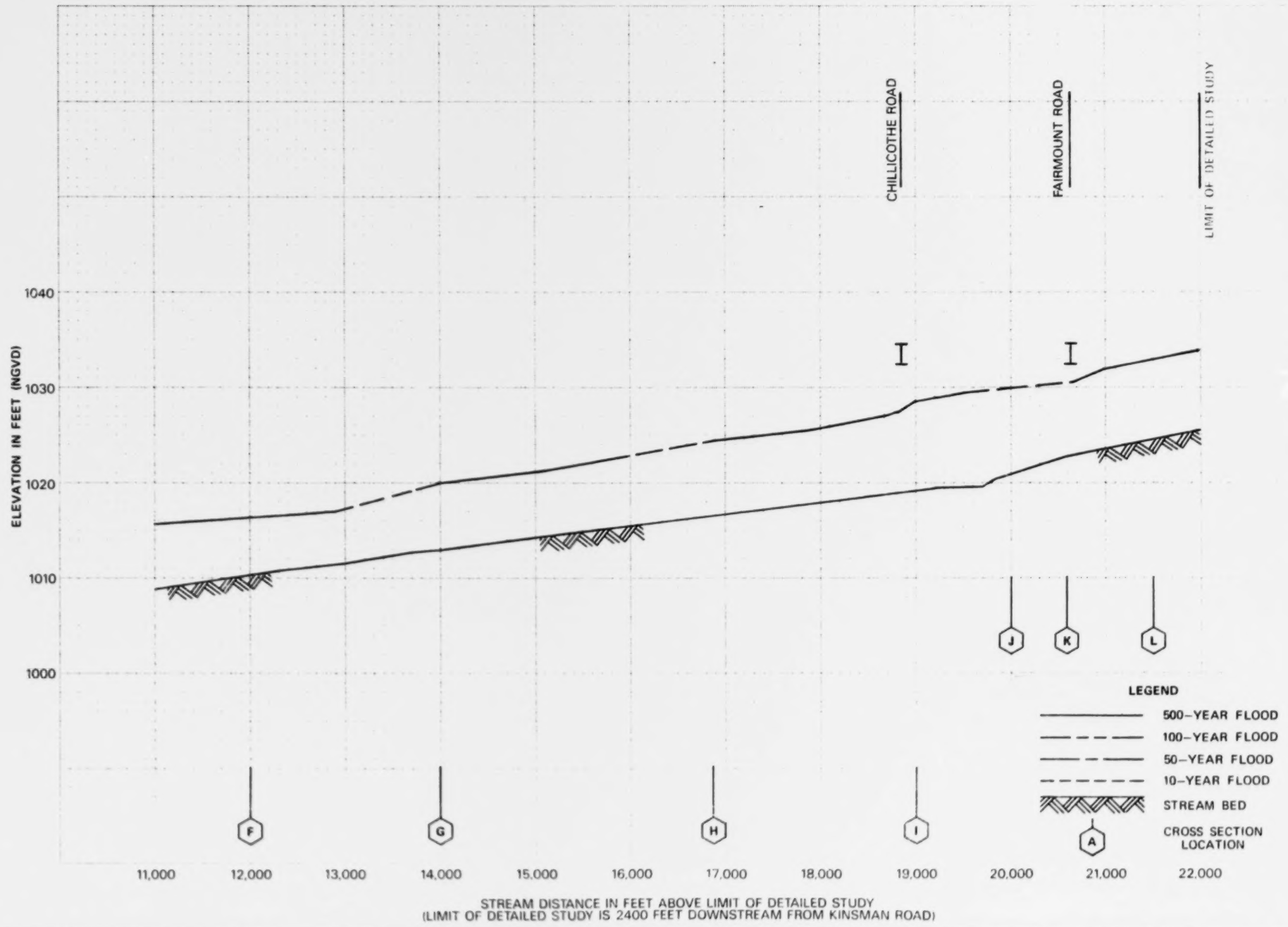
REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0132	986.31	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 18 feet east of centerline of driveway at 17207 Swine Creek Road
2	0132	991.40	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 23.8 feet south of intersection of Swine Creek Road and Hayes Road
3	0058	1141.81	standard tablet stamped "ER 18 1952 TT" in northwest abutment of Auburn Road bridge over the Chagrin River
4	0108	1184.49	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 29.5 feet north of Stafford Road, 5.5 feet northeast of pole number 72P28
5	0114	1048.97	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 15 feet north of intersection of Chillicothe Road and Crackel Road
6	0112	1062.97	point in center top of concrete culvert on west side of Riverview Drive, south of North Spring Valley Road
7	0059	1136.76	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 65 feet north of Spencer Road, 134 feet northeast of Mayfield Road
8	0013	875.19	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in top of west abutment of Kirtland Road bridge over the East Branch Chagrin River

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
9	0013	853.18	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 63 feet southwest of intersection of Wisner Road and Mitchell's Mill Road
10	0064	1039.31	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 44.5 feet northeast of center of intersection of Chillicothe Road and Silver Creek Drive
11	0064	1066.88	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located on north side of Kinsman Road near Surry Downs Drive, 10 feet northeast of pole number 519611
12	0125	1202.97	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located 32.5 feet south of Stafford Road, 9 feet southeast of pole number 72P21
13	0125	1154.92	2.5-inch diameter brass plate stamped "Geauga County Control Survey" set in concrete post located along Taylor-May Road, 27 feet west of intersection with Thorpe Road



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **GEAUGA COUNTY, OH** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **CHAGRIN RIVER**



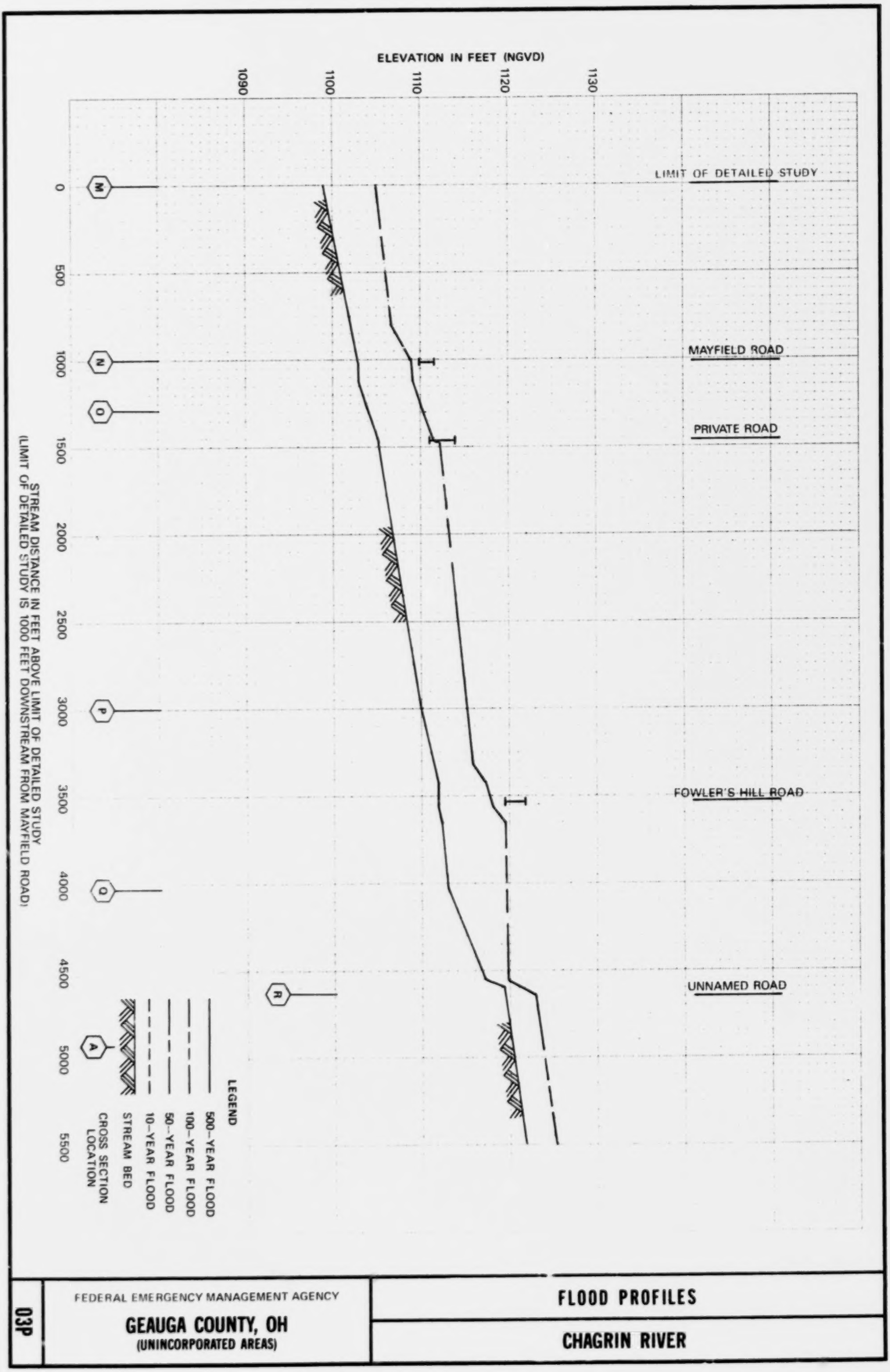
FLOOD PROFILES

CHAGRIN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

02P



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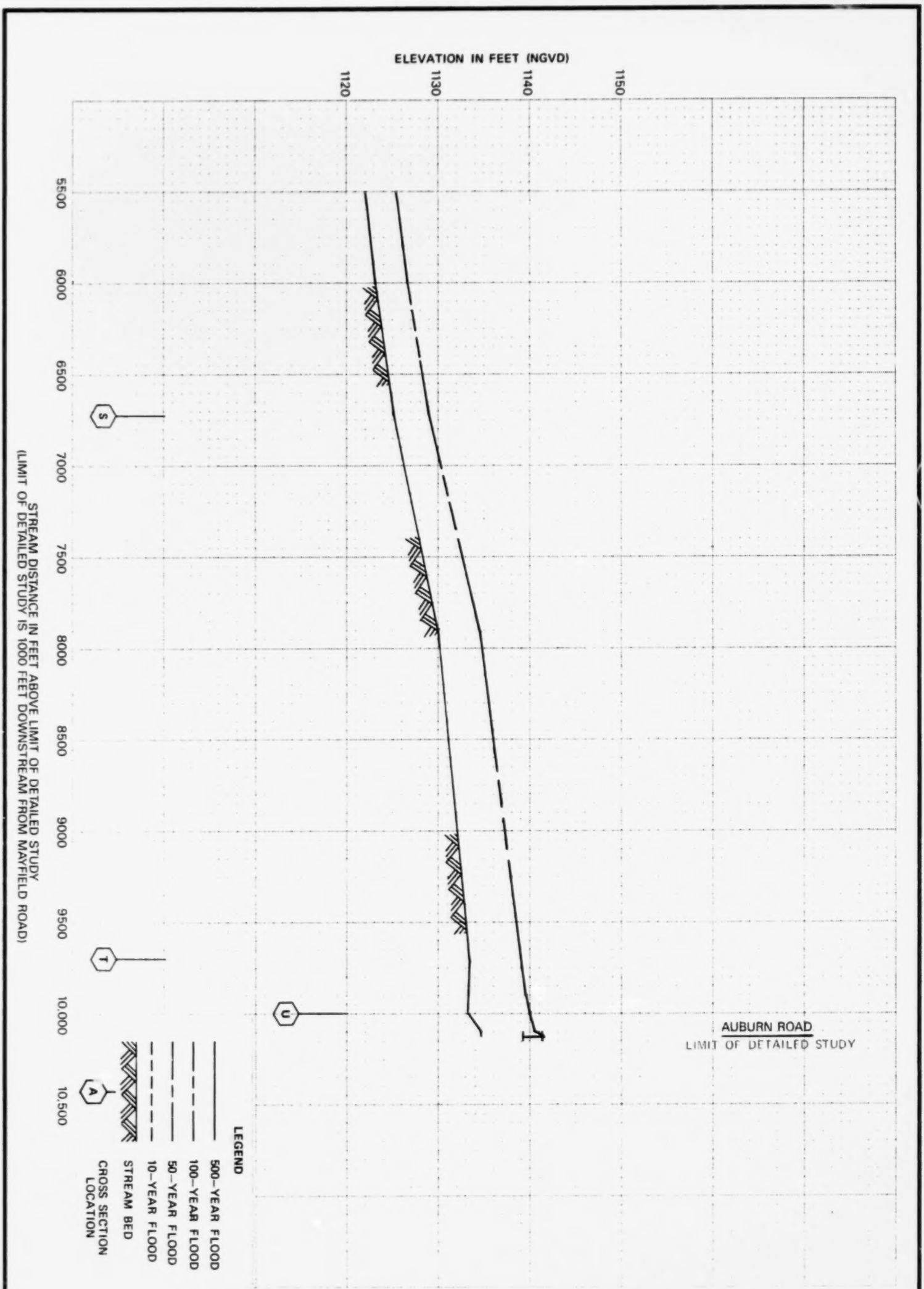


04P

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

CHAGRIN RIVER

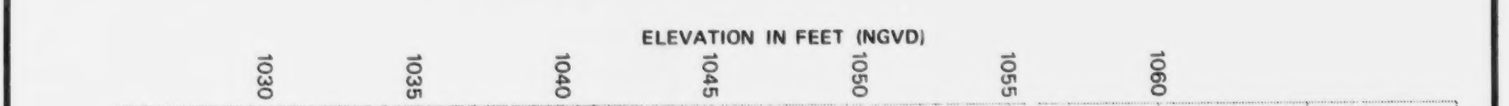
FLOOD PROFILES

EAST BRANCH CHAGRIN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

05P



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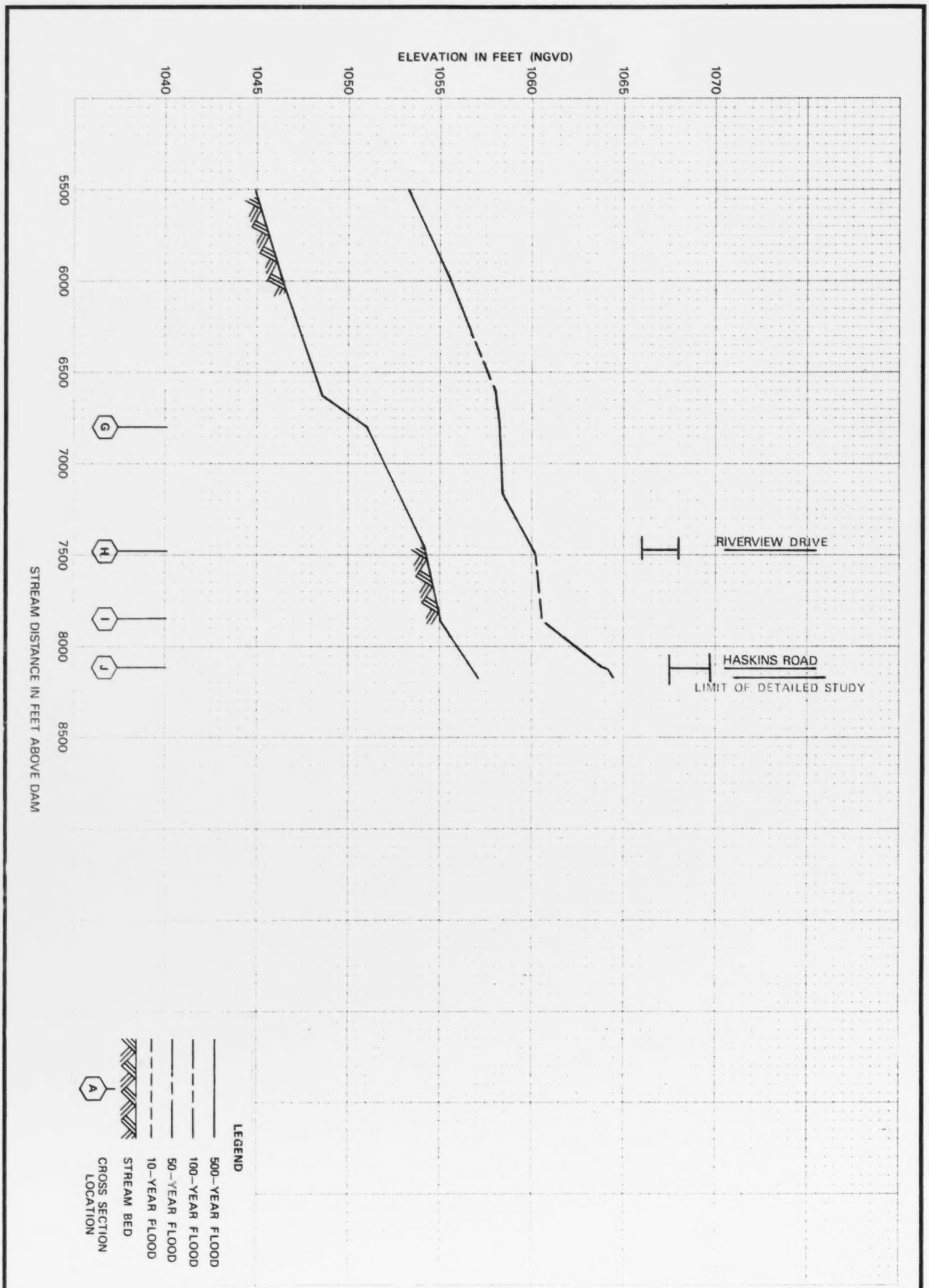

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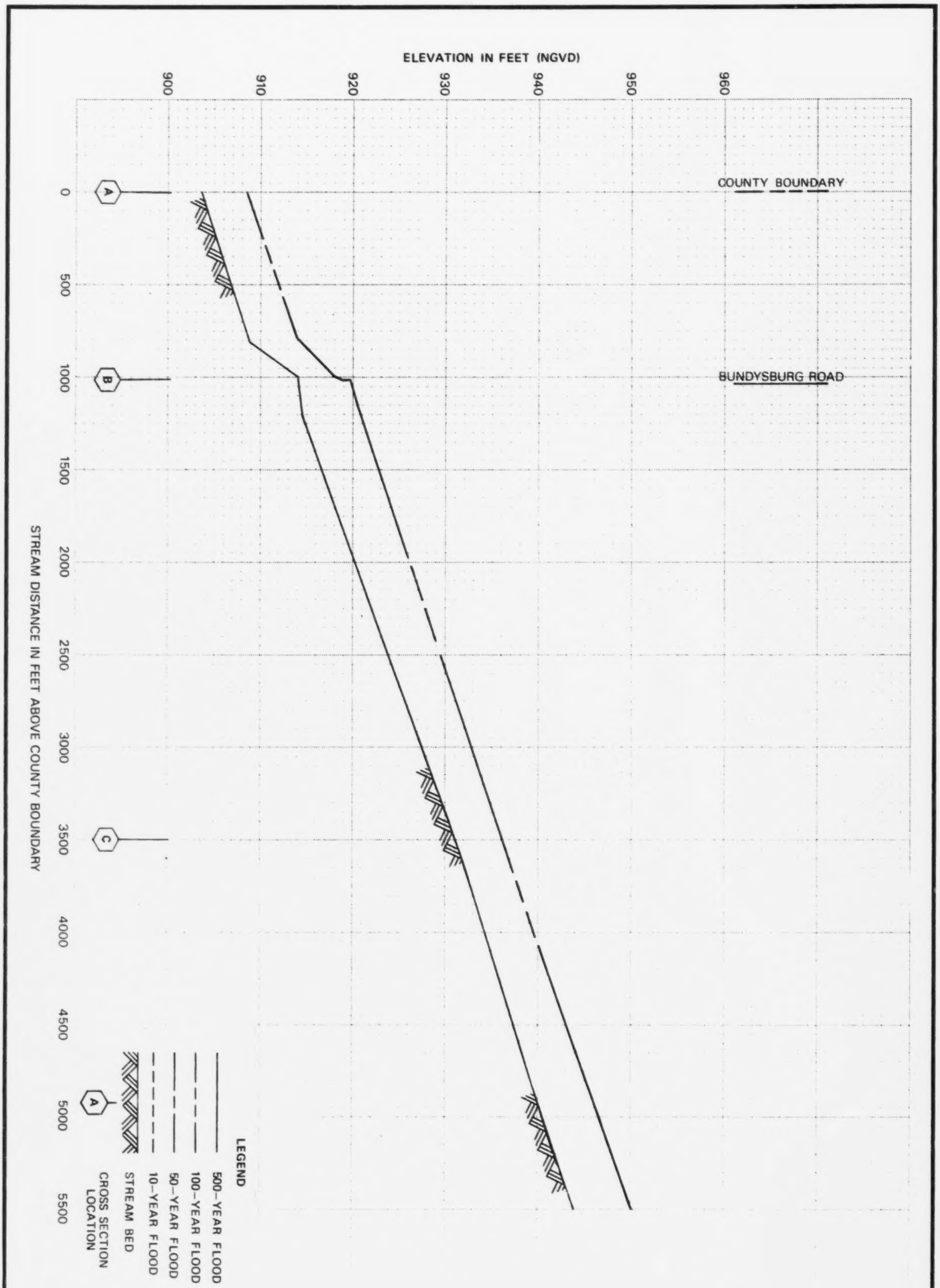
07P

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

UNNAMED TRIBUTARY TO AURORA BRANCH CHAGRIN RIVER



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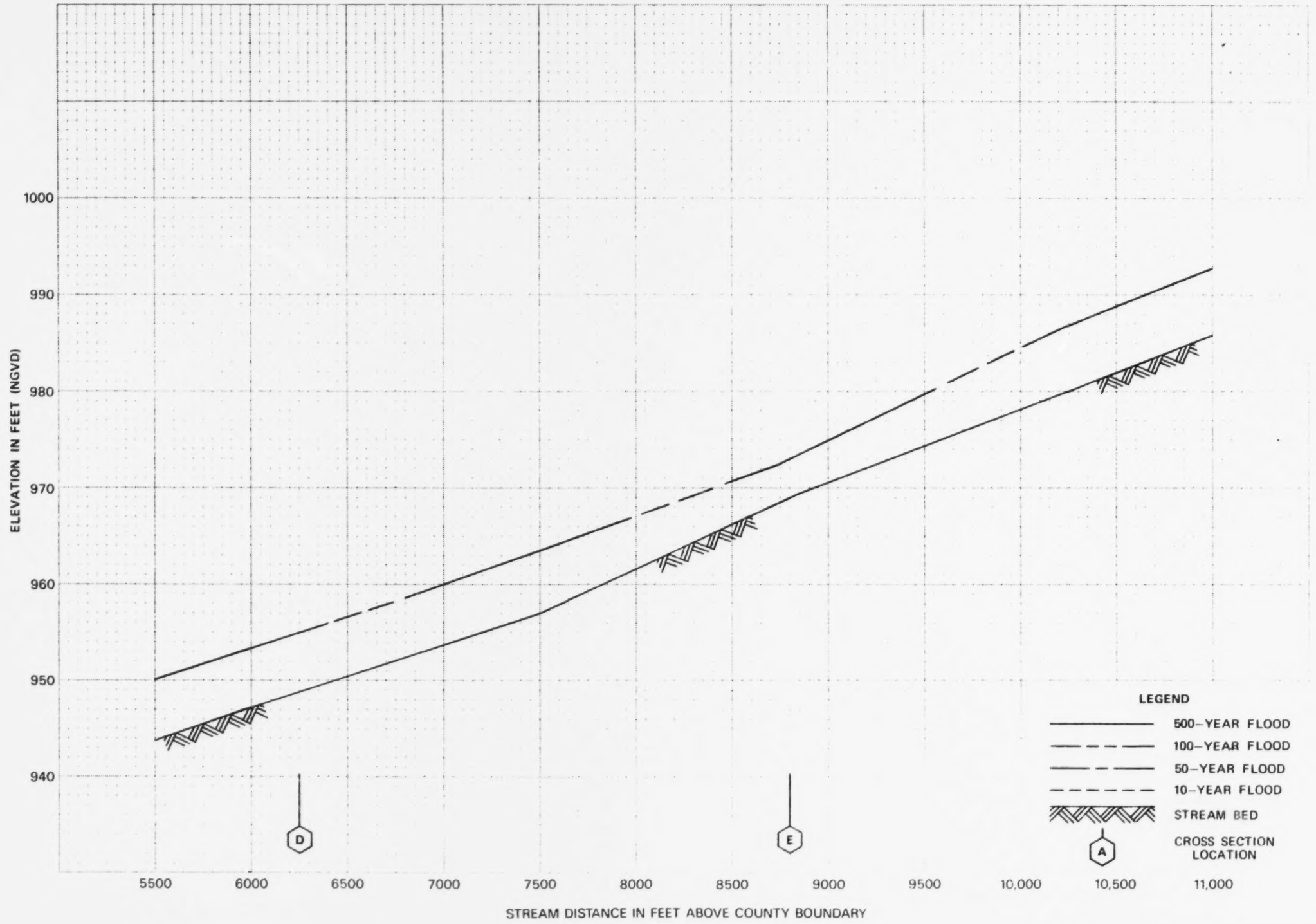


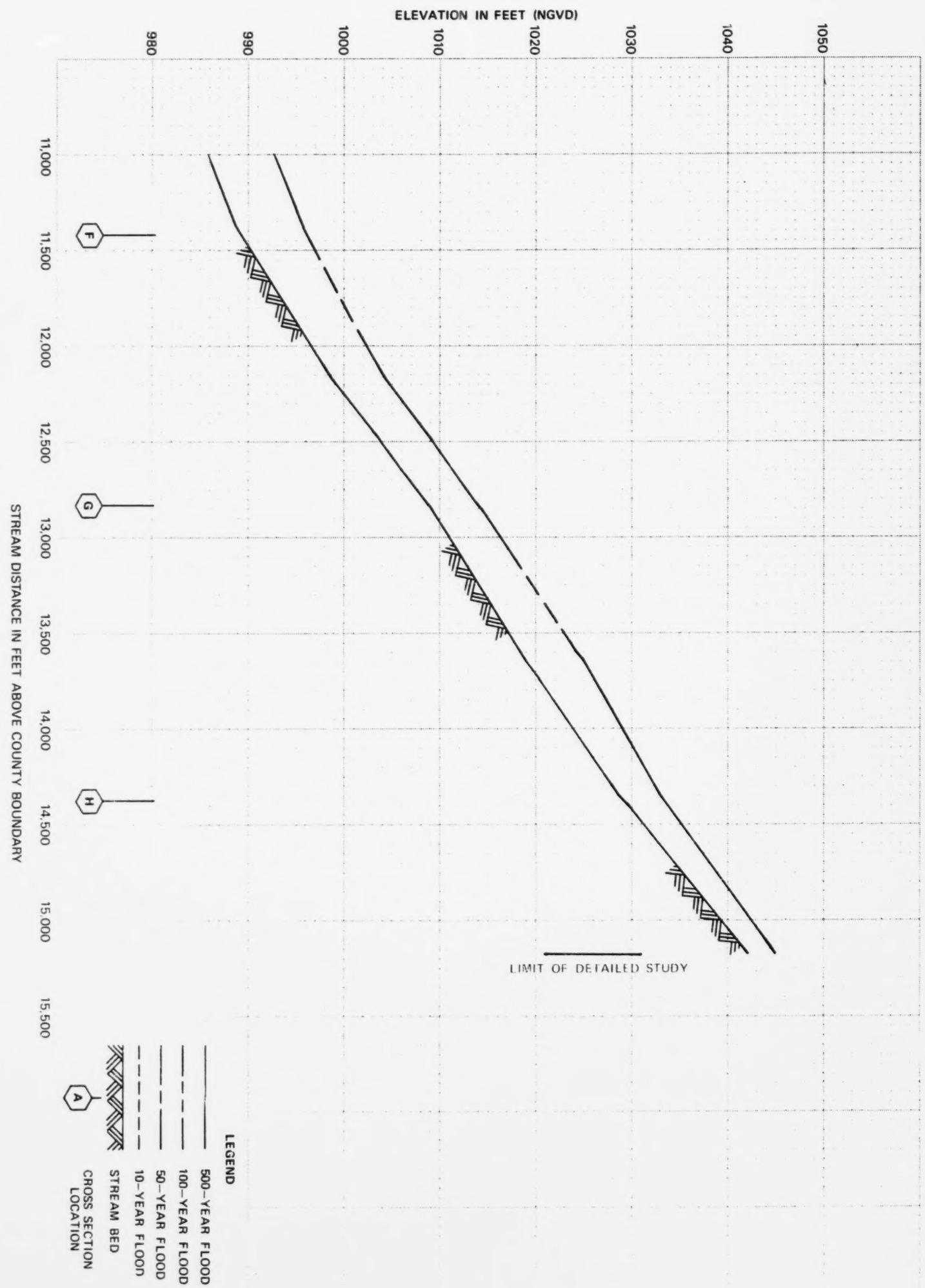
FLOOD PROFILES

SWINE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

09P



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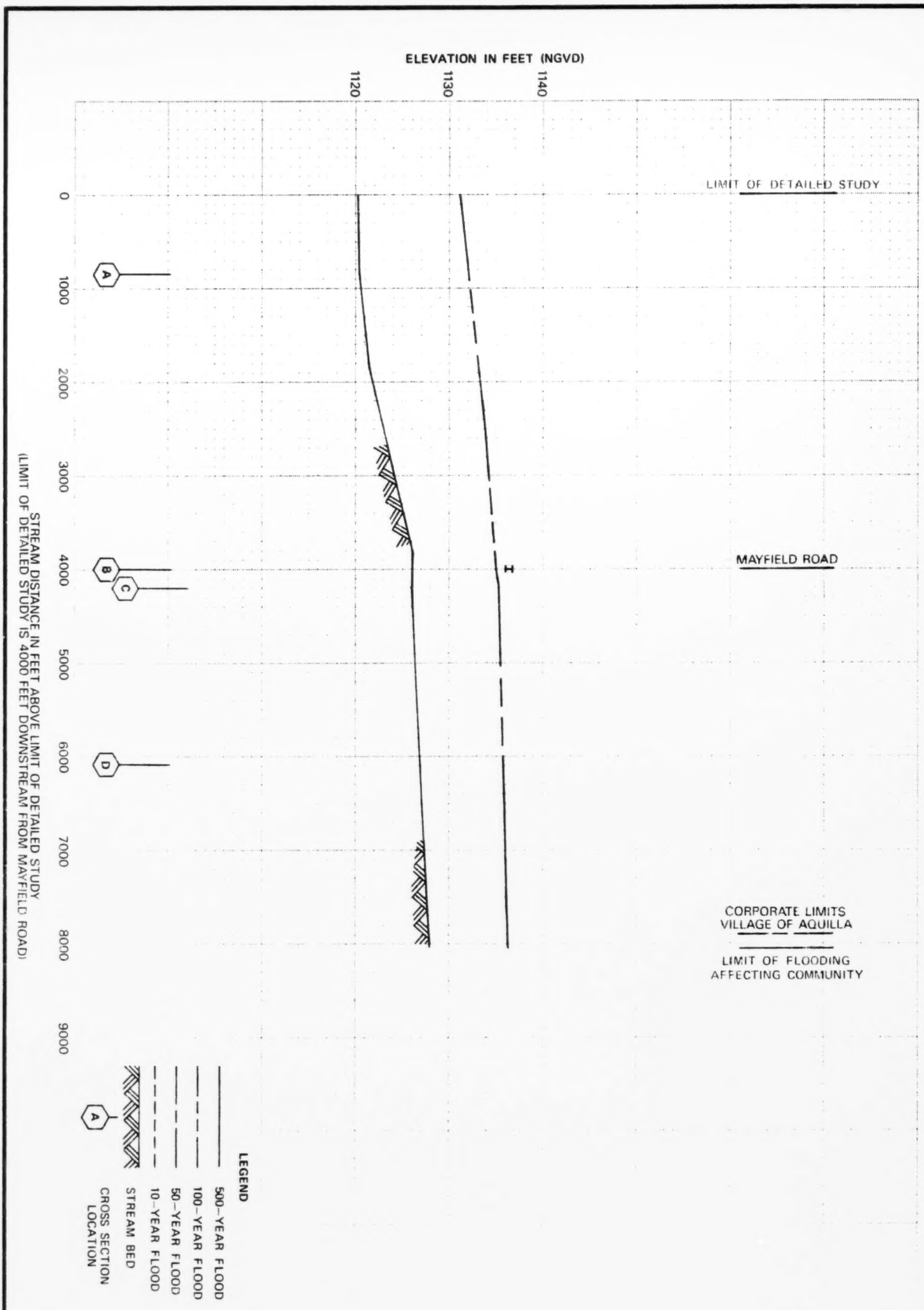

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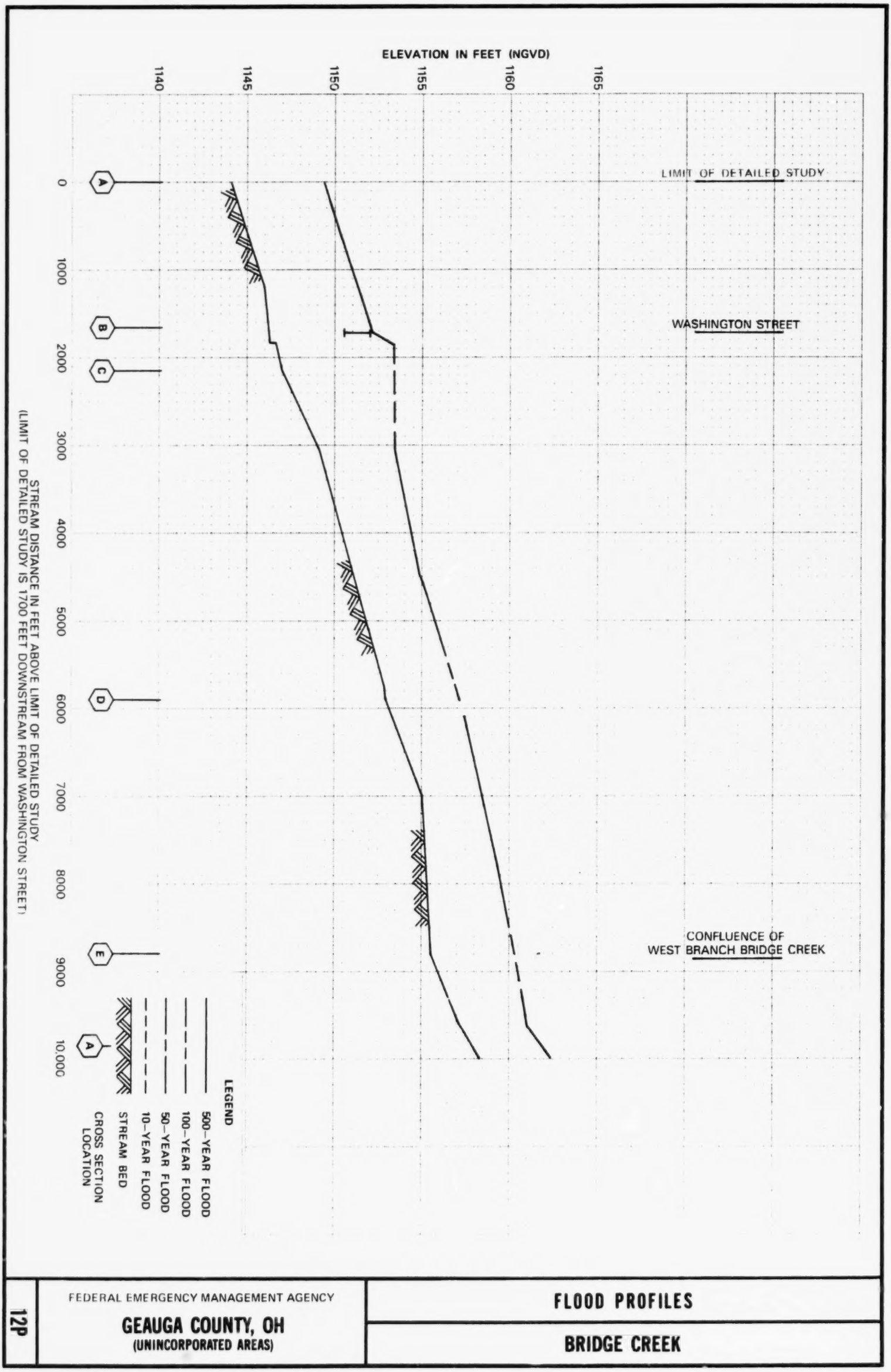

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12P	FEDERAL EMERGENCY MANAGEMENT AGENCY **GEAUGA COUNTY, OH** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **BRIDGE CREEK**

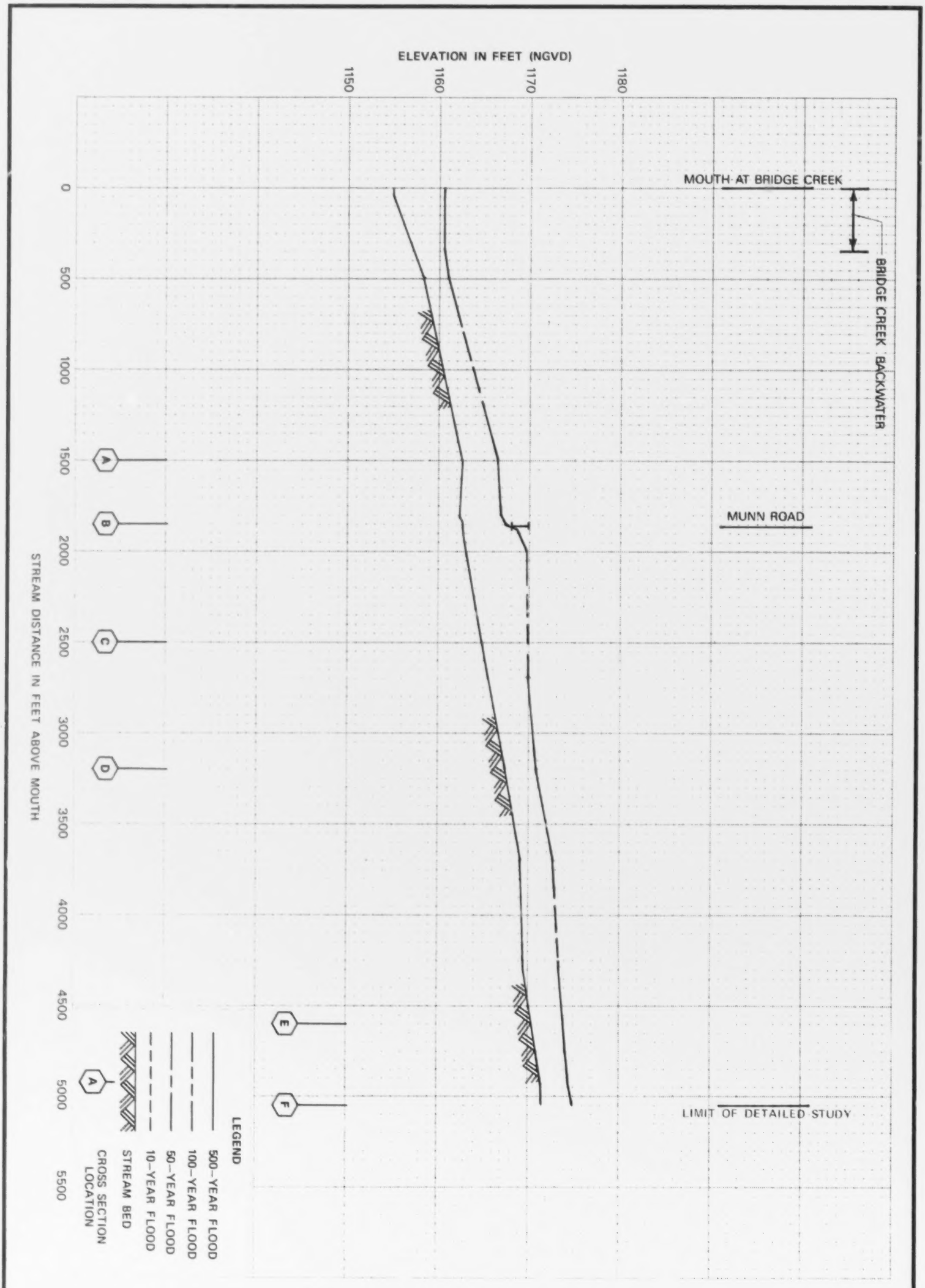
FLOOD PROFILES

BRIDGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

13P



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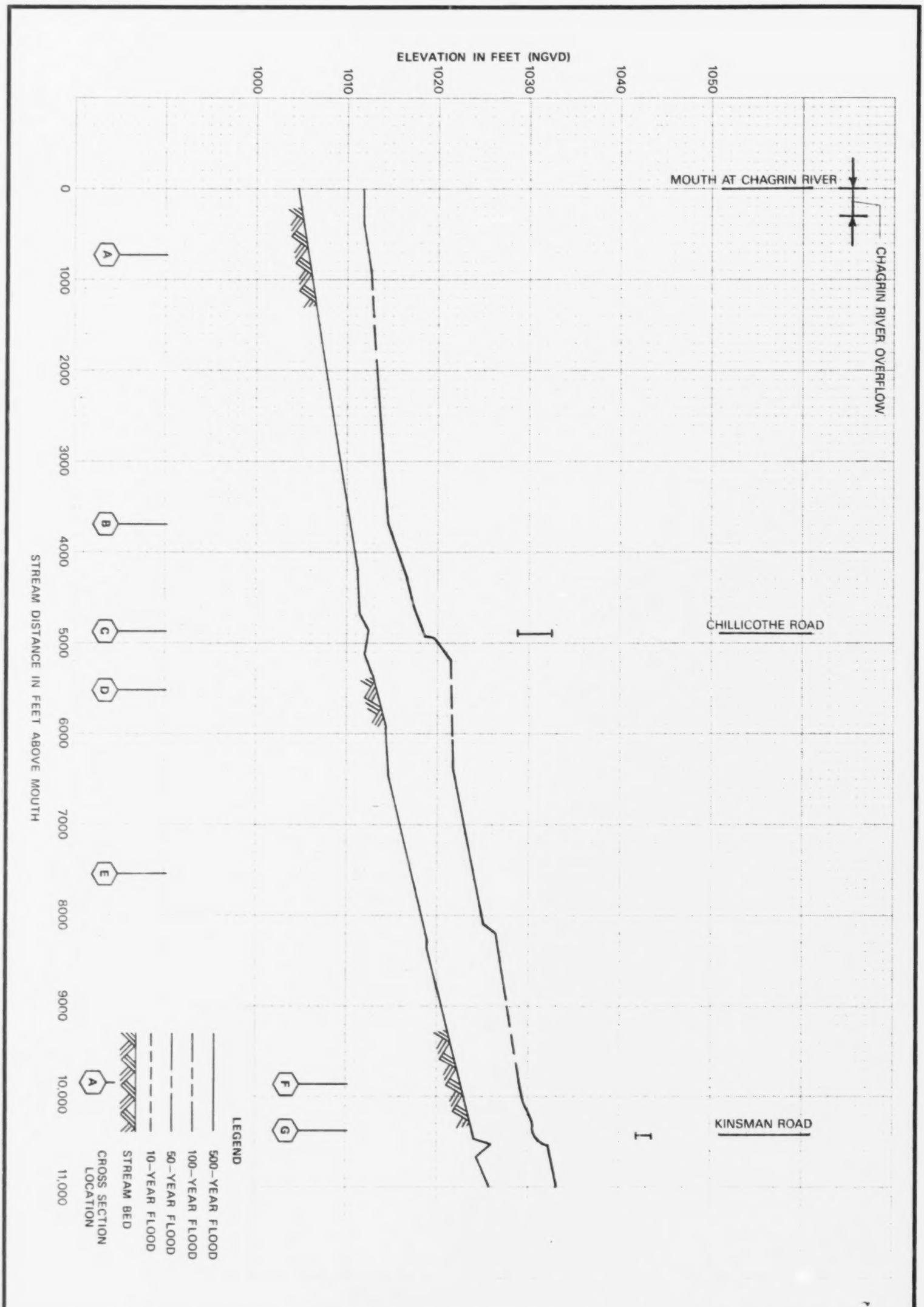


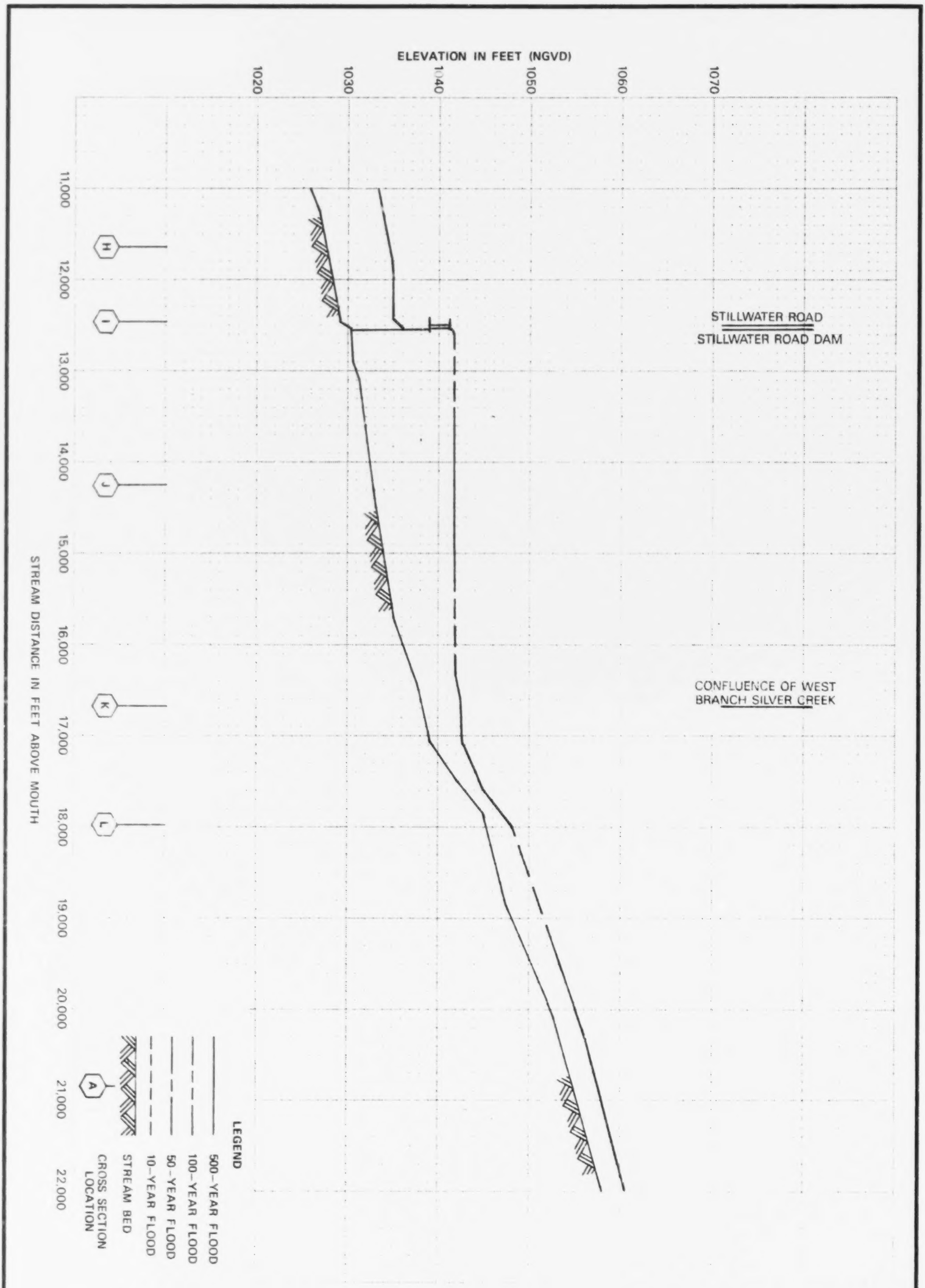
15P

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

SILVER CREEK



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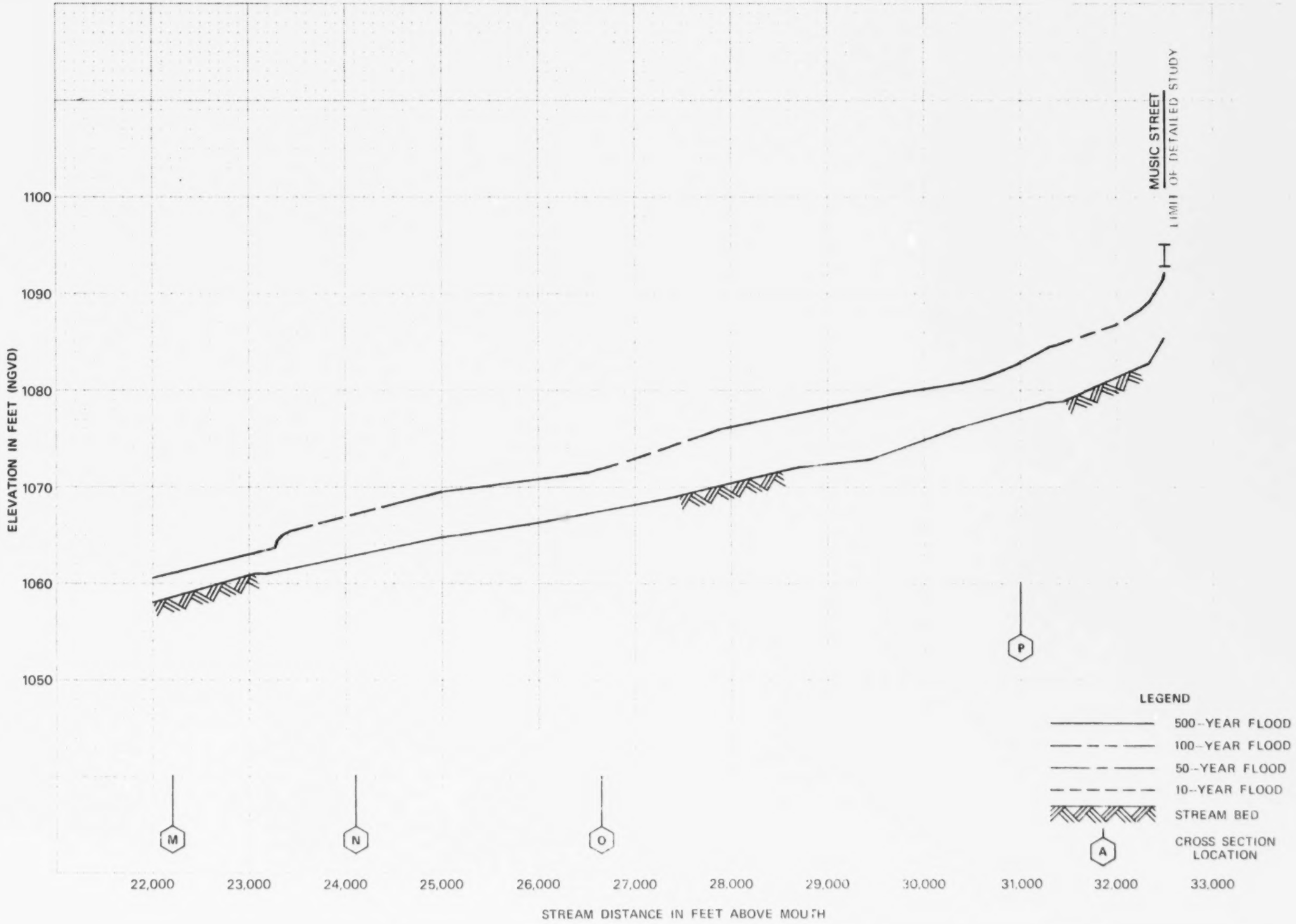


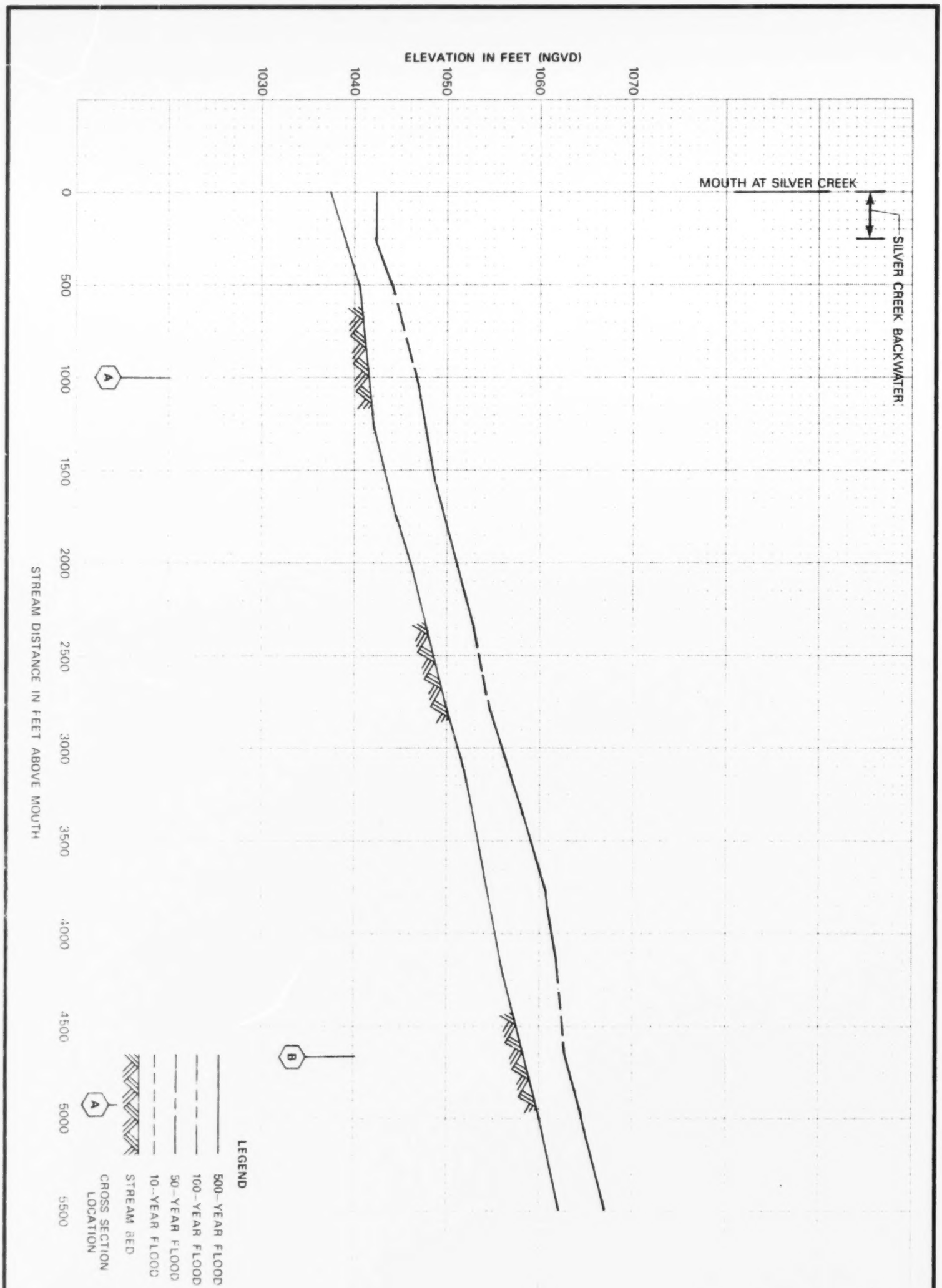
FLOOD PROFILES

SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

17P



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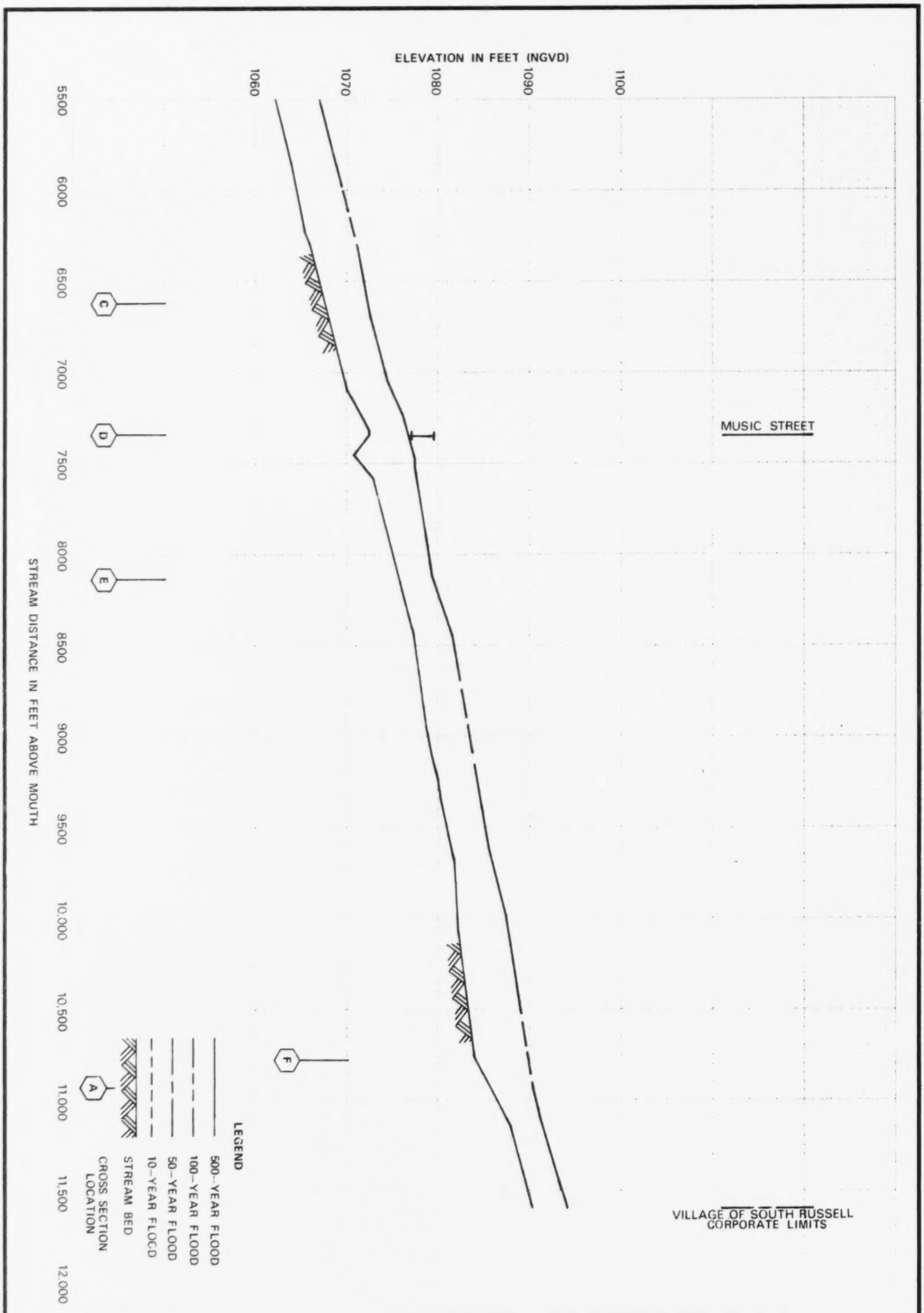

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19P

FEDERAL EMERGENCY MANAGEMENT AGENCY

GEAUGA COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

WEST BRANCH SILVER CREEK